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Comparing 2D vs 3D Mammography in Breast Imaging

Kelsey Little
kelseylittle8@gmail.com

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MISERICORDIA UNIVERSITY

Student Researcher: Kelsey Little

Faculty Advisor: Dr. Elaine Halesey, Ed.D., R.T.(R)(QM)

Mammography Introduction

Mammography uses low dose radiation to take images of breast tissue in two different projections. Equipment used is frequently evolving to improve image quality and comfort for the patient.

- **Screening mammograms**
  - Performed on asymptomatic patients who have no known breast issues
  - Recommended to begin yearly screenings at the age of 40
  - Screenings for breast cancer are essential to early detection and decreasing mortality rates
- **Diagnostic mammograms**
  - Specific projections used to to dismiss cancer or further investigate a suspicious area found on a routine screening
  - Another indication includes palpable masses
  - Spot compression or magnification views

(Long, Rollins, & Smith, 2016, p. 378)

Mammography Projections

- **Routine Projections**
  - Usually includes craniocaudal (CC) and mediolateral oblique (MLO) projections
  - CC and MLO views visualize a substantial amount of breast tissue (Long et al., 2016, p. 411)
- **Additional Projections**
  - Typically include a 90° mediolateral (ML) or lateromedial (LM) projection for better visualization
  - Spot compression and magnifications views enhance the area being investigated

(Long et al., 2016, pp. 427, 433, 435)

Breast Cancer

- One of the most frequent cancers detected in women
- One of the most treatable types of cancers
- Early detection and better methods of treatment have greatly decreased breast cancer death rates
- Can be detected on mammograms as masses, calcifications, areas of asymmetry, etc.

(DenseBreast-Info, n.d., para. 4; Long et al., 2016, p. 371)

2D Digital Mammography (DM)

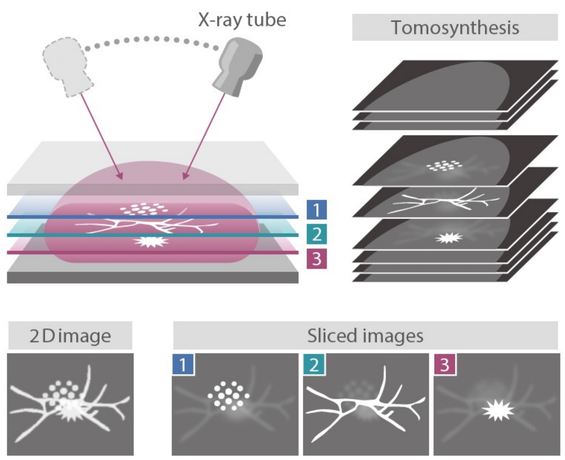
- Also known as full-field digital mammography
- Uses an electronic detector to computerize and display the information
- Takes a stationary image of a compressed breast without any movement of the tube

(DenseBreast-Info, n.d., para. 7)

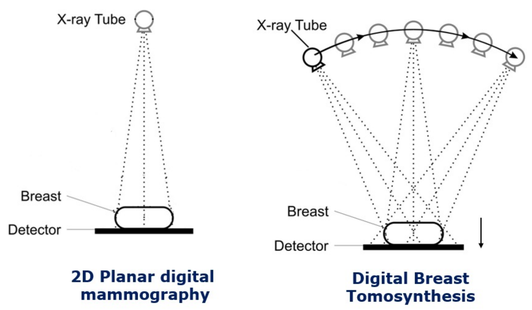
3D Digital Breast Tomosynthesis (DBT)

- Three-dimensional imaging
- Equipment takes images of a stationary, compressed breast at multiple angles
- Displays breast tissue in thin slices
- Better visualizes cancers from surrounding breast tissue

(Long et al., 2016, p. 375; Winter, Kazmi, Hardy, & Bennett, 2020, p. 1954)



This figure demonstrates how DBT takes the image in slices, to visual different layers of the breast compared to DM where the image overlaps tissue. (Fujifilm, n.d.)



(Medical Physics – Royal Surrey County Hospital, 2018)

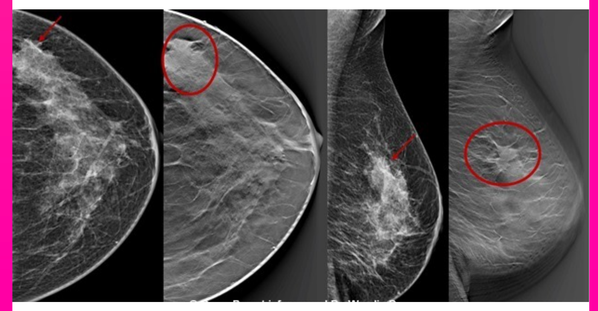
2D vs 3D Mammography

- **Advantages of DBT in a diagnostic setting:**
  - Cancerous lesions are more visible with 3D
    - Most cancers detected are invasive rather than in situ
  - Improves diagnostic performance and better predictive values regarding biopsies compared to DM
    - Reduces benign biopsies and permits better margin analysis
  - Reduces additional views needed while Increasing sensitivity and specificity
  - Improves radiologist's confidence
  - Overall, 3D has more potential in diagnostic imaging than 2D

(Bahl, Mercaldo, Vijapura, McCarthy, & Lehman, 2018, pp. 482-483; Mall et al., 2018, pp. 5183, 5192)

- **Advantages of DBT in a screening setting:**
  - One study found a 65% increase in the detection of cancer using 3D DBT imaging
  - Reduces call back rates and has better detection of interval and node positive cancers

(Procasco, 2016, p. 350; Winter et al., 2020, p. 1958)



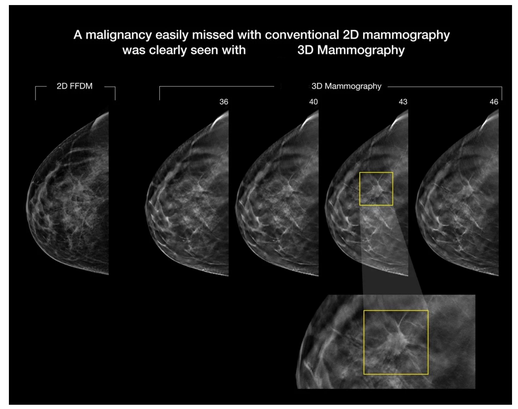
Arrows point to where an irregular mass was missed with 2D imaging while the circles highlight better visualization of the mass with 3D imaging (DenseBreast-Info, n.d.)

- **Disadvantages of DBT:**
  - Slight increase of radiation dose to the patient
  - More false-positive exams due to architectural distortion with DBT compared to DM
  - DBT tends to result in more false-positive exams of masses

(Bahl et al., 2018, p. 483)

Discussion

- According to Bahl et al. (2018) and Winter et al. (2020), DBT did demonstrate improved performance, but no significant difference in cancer detection rates between DBT and DM
  - Winter et al. (2020), also found that there was not a significant difference in the detection of interval cancers between 2D and 3D mammography
- On the contrary, Mall et al. (2018) and Procasco (2016) discovered DBT has more potential than DM in the detection of cancer
  - Lesions were found to be more visible with 3D imaging
- Research indicates while 3D does have some advances over 2D breast imaging, there is not a great difference between the two in their diagnostic capabilities
- With mammography technology changing frequently, it may be necessary for future studies to be conducted in both screening and diagnostic settings to compare whether 3D breast imaging is superior to 2D imaging in the detection of breast cancer



Mammogram taken with 2D imaging, and the same breast imaged again with 3D. The malignancy was not seen on 2D but was with DBT. (Image Technology News, 2014)

Conclusion

Overall, DBT has the capability of producing better quality images in most instances. Both DBT and DM produce acceptable images, but DBT is slightly better in certain areas. DBT and DM are capable of being combined to create better quality images.

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